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# CLASSIFYING THE ECONOMY INTO TRADED OR NONTRADED SECTORS*

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## I. INTRODUCTION

An economy is said to be small if it is a price-taker in the world markets for its importables and exportables. The devaluation of the domestic currency of a small country will not alter its terms of trade and cannot be expected to improve its trade balance by making imports more expensive in terms of exports, as the traditional elasticities approach suggests. But devaluation can still help the small economy achieve external balance through relative price changes if a third class of goods that are not internationally-traded is considered important in its domestic production and consumption.

Models which divide the economy into the traded and nontraded goods sectors were first developed by Meade (1956), Salter (1959) and Swan (1960, 1963) while studying the Australian economy. A devaluation is said to immediately increase the domestic price of importables and exportables relative to nontradables. Production resources will therefore shift from the nontraded goods sector to the traded goods sector while domestic demand will shift from the latter to the former. These shifts in production and consumption will increase exports and decrease imports. Thus, devaluation would improve the trade balance through its relative-price effect.

The relative-price effect which produces excess demand for nontraded goods will increase their price and, together with the higher domestic prices of traded goods, bring about inflation. The increase in the general price level will decrease the money supply in real terms if the nominal stock is kept constant. According to the monetary approach to the balance of payments, which was first suggested in Frenkel and Johnson (1976), when the real balances that people hold fall short of the desired level, they will reduce their real spending in order to accumulate their desired real balances. The increase in saving will reduce the demand for both tradables and nontradables. The former will decrease the excess demand for import-

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ables and increase the excess supply of exportables. Imports will fall and exports will increase and the trade balance will be further improved by the real-balance effect of the devaluation. In the nontraded goods sector, the fall in demand will dampen the price increase and help to preserve the relative-price effect of the devaluation.

These relative-price and real-balance effects of devaluation on the trade balance were first put together by Mundell (1971), Dornbusch (1973) and Krueger (1974). They showed that devaluation can improve the trade balance not only by switching expenditure from traded to nontraded goods but also by reducing the level of real expenditure. These models, however, cannot be used to look at the effects of devaluation on real output since they assume that prices are so perfectly flexible as to always maintain the full employment level of income. The experience of the Philippines as well as of other countries, as first noted by Cooper (1971a, b), indicates that devaluation can have a significant effect on output.

In her doctoral dissertation, therefore, this author developed a model with a sticky nominal wage to study the impact of devaluation on real output. In essence, it shows that a devaluation will lower the wage in terms of traded goods and therefore encourage their production. In the nontraded goods sector, equilibrium output will be determined by the effects of devaluation on the domestic demand for and supply of nontraded goods.

On the demand side, a devaluation lowers the price of nontraded goods relative to traded goods, thereby encouraging a shift in domestic expenditure from traded to nontraded goods. On the other hand, by decreasing real balances, and possibly real expenditure, a devaluation dampens the demand for nontraded goods. On the supply side, a devaluation will increase the price of imported inputs used in the production of nontraded goods. Thus, output will tend to fall. If the price of nontraded goods which is determined by market-clearing conditions goes up, the product wage falls and production is encouraged. The net effect of a devaluation on the equilibrium output of nontraded goods will depend on the responsiveness of demand and supply to the changes in relative prices and real balances. The author's model postulates conditions under which a devaluation can have an expansionary effect on the nontraded goods sector and, together with the increase in output in the traded goods sector, on total output.

The theoretical model as developed by the author can be used to study the devaluation experiences of the Philippines, a small open economy which faces balance of payments crises periodically.

Such an empirical application of the model will not only provide a test of its validity and relevance but can also provide policy-makers with an indication of the costs of devaluation as a tool for achieving external balance. Data on the Philippine economy for the period 1967-86 were used to illustrate the use of the model and to determine if devaluation is contractionary or expansionary in the Philippine setting.

As a starting point in the application of the model, this author first catergorized key Philippine industries as traded or nontraded through the use of discriminant analysis on the basis of information on actual import and export values relative to domestic output as well as on the movement of domestic prices relative to foreign prices. This process is described in this brief paper.

## II. CLASSIFYING SECTORS AS TRADED OR NONTRADED

A number of theoretical works on international trade, optimum currency areas and balance of payments management have treated nontraded goods explicitly and defined them in some way. Non-traded goods have been defined to be goods which do not enter into international trade either because their transportation is not feasible (Harrod 1958; McKinnon 1963), transportation costs are too high (Jones 1974) or tariffs are too high (Dornbusch *et al.* 1977). Because they are not internationally-traded, these commodities must have their markets cleared domestically, and it is in this respect that they differ fundamentally from traded commodities for which domestic excess demands or supplies can be accommodated in world markets. Thus, while the domestic prices of traded goods are expected to move closely with their world prices and the exchange rate, the price level of nontraded goods will be determined by domestic demand and supply conditions.

There have been a few empirical studies which have required price indices for traded and nontraded goods. In his application of the Salter (1959) and Dornbusch (1974) models of devaluation to Mexico, Krugman (1977) used the United States wholesale price index (WPI) as a proxy for the traded goods price index. He then used three Mexican domestic price indices — the wholesale price index, consumer price index (CPI) and gross domestic product deflator — which cover both traded and nontraded goods so that their ratio to the US WPI could approximate the relative price of traded goods in terms of nontraded goods.

Corbo (1983), in extending the Salter (1959) model to study inflation in Chile, needed the CPI for domestically consumed homo-

geneous tradables, for domestically produced differentiated tradables and for nontradables. Since the WPI had components for the two types of tradables, he assumed that the tradables subcomponents of the CPI were proportional to those in the WPI. The nontradables had no separate component in the WPI and their price was estimated indirectly using the estimated price indices for the tradable goods, their WPI weights, labor costs, labor productivity in the nontradables sector and excess demand for nontradables.

In his empirical work on the effect of real exchange rate changes on real output growth, Edwards (1986) used as proxy for the relative price of tradables to nontradables the product of the nominal exchange rate with respect to the US dollar and the ratio of the US WPI to the domestic CPI. Since these studies required only price indices or relative prices for traded and nontraded goods, there was no need to actually categorize goods or industries as traded or nontraded. The available price indices were deemed suitable proxies for the price data required.

Empirical testing of the model developed by the author, however, required not only price data but also measures of output. Since there are no existing aggregate output series for traded and nontraded goods, these will have to be built up from industry data after an explicit categorization of industries as traded or nontraded. The use of industry-by-industry data on output and relative factor prices rather than a more aggregated approach is also expected to yield more meaningful econometric estimates of the demand and supply elasticities in the model. The identification of industries comprising the tradables and nontradables sectors will also make possible the construction of price indices along the lines suggested by Harberger (1986), i.e., that the technically best index for nontraded goods would be one built up from the implicit price deflators for the various sectors. This can then be used to deflate a foreign price index to get the real exchange rate.

### A. *Quantity Criterion*

In categorizing sectors as traded or nontraded, a useful starting point would be data on actual import and export values relative to domestic consumption or production. If a good is imported or exported in significant amounts, it is likely that its domestic price would move closely with its world price. If, for example, the domestic price of an exportable good is much lower than the world price, producers would sell more of the good abroad, decreasing the amounts available for domestic consumption and pushing up the

domestic price. If, on the other hand, the domestic price of an importable good is much higher than the world price, the availability of lower-cost imports will force the price of domestic substitutes down, making it more competitive.

Data from the Input-Output Transactions Tables for 1969, 1974, 1979 and 1983 were therefore used to classify industries as tradable or nontradable on the basis of the quantity criterion. The ratio of the sum of import and export values to domestic output was computed for each industry. The rule of thumb adopted was, if the average ratio for the four years is greater than 10 percent, the industry may be considered tradable. Table 1 presents the average ratio for 29 key Philippine industries. It should be noted that although sugarcane itself is not exported, it is refined and then exported in significant amounts. Thus, the average ratio of 50 percent for refined sugar is also used for sugarcane.

## B. *Price Tests*

Although significant trade volumes indicate that an industry should be categorized as tradable, the absence of trade does not necessarily preclude an industry from being considered as such. This is because the potential of tade alone could keep domestic prices in line with world prices. The availability of lower-cost imports or the existence of world demand for exports could prevent domestic prices from going far out of line with world prices. Thus, the relationship of an industry's domestic prices with world prices should also be analyzed. If the domestic price of a good moves closely with its world price multiplied by the exchange rate, then it can also be considered tradable.

One test to determine how closely the industry domestic price, $P$, approximates its world price in domestic currency, $P'$, is an ordinary least squares regression of the former against the latter, both in logarithmic form, with correction for serial correlation through the maximum likelihood iterative technique. For any given industry.

$$\text{Log } P = a + b \text{ Log } P' \qquad (1)$$

Another test which looks at how closely the domestic price moves up or down with the world price in domestic currency is an ordinary least squares regression of their first differences. Thus,

$$\text{Log } (P_t - P_{t-1}) = c + d \text{ Log } (P'_t - P'_{t-1}). \qquad (2)$$

**Table 1**
**RESULTS OF QUANTITY TEST**

| Industry | Ratio of imports + exports to domestic output |
|---|---|
| Machinery and equipment | 177 |
| Copper | 90 |
| Metal products | 65 |
| Chemical products | 61 |
| Sugarcane | 50 |
| Textiles | 44 |
| Paper products | 41 |
| Wearing apparel | 31 |
| Hotel, restaurant and recreation services | 29 |
| Other transportation and communication | 26 |
| Bananas | 20 |
| Coconut including copra | 18 |
| Food products | 18 |
| Nonmetallic products | 18 |
| Publishing and printing | 15 |
| Petroleum products | 13 |
| Wholesale and retail trade | 10 |
| Land transportation | 8 |
| Corn | 7 |
| Finance and insurance | 5 |
| Other private services | 5 |
| Tobacco products | 4 |
| Beverages | 3 |
| Construction | 2 |
| Rice | 1 |
| Fishery | 1 |
| Livestock | 0 |
| Poultry | 0 |
| Electricity, gas and water | 0 |

A third test would be a simple calculation of the variance of the logarithm of the domestic price, $P$, minus the logarithms of the exchange rate, $E$, and the world price, $P^*$, to determine if the domestic price is kept as a constant proportion of the world price. The variable $X$ is defined to be:

$$X = \text{Log } P - \text{Log } E - \text{Log } P^* \qquad (3)$$

The domestic price of each industry, $P$, is given by its implicit price deflator derived from the national income accounts on Gross National Product by Industrial Origin. These accounts were available on a semiannual basis for the years 1967 to 1986. The corresponding world prices are from a variety of sources. For primary commodities such as rice, corn, sugar, coconut, bananas and copper which are largely homogeneous and traded in well-organized international markets, price data for representative goods which have been monitored by the United Nations Committee on Trade and Development and the Intrnational Monetary Fund are used. For the other industries, price indices in the US are the bases for comparison since the US has been the largest trading partner of the Philippines over the years and because price trends in the US reflect as well as affect prices in world markets to a significant degree. The producer price index is used for eleven industries in the agricultural and manufacturing sectors, the consumer price index for urban wage earners for six industries in the manufacturing and service sectors, and for five service industries. A special construction cost index prepared by the US Engineering News-Record is used for the construction industry. Table 2 gives a detailed description of the foreign price series used for each industry.

The test results for 29 key Philippine industries are presented in Table 3. For the first two tests, the regression coefficients are followed by an asterisk if the t-statistic is significant at the 5 percent level. The variance of the variable $X$ is presented in the third column. To give an indication of the "tradedness" of an industry, the regression coefficients of the industries were ranked from highest to lowest and the variances ranked from smallest to biggest. Those with the highest regression coefficients and lowest variances would be more tradable than those with lower coefficients and higher variances. It can be observed from Table 3 that the domestic prices of almost all the industries which are considered tradable according to the quantity criterion move closely with their world prices. The only exceptions are sugarcane and publishing.

## C. *Discriminant Analysis*

To verify the above observation and to identify any industries which do not have significant import and export values but which should be classified as tradable because their domestic prices move closely with their world prices, discriminant analysis of the numerical results of the three price tests was undertaken. Industries were initially classified according to the quantity criterion. A discriminant model or classification criterion was then developed using a measure

**Table 2**
**FOREIGN PRICE INDICES**

*AGRICULTURE*

*Rice:* Bangkok f. o. b. price for white Thailand rice, 5% broken, US$ per metric ton[1]

*Corn:* Gulf ports f. o. b. price for US No. 2 yellow corn, US$ per bushel[1]

*Sugarcane:* Negotiated export price for sugar from ACP countries to European Economic Community under the Sugar Protocol, US cents per pound[1]

*Coconut including copra:* European ports c. i. f. price for Philippine/Indonedian copra, US$ per metric ton[1]

*Bananas:* US ports f. o. b. price for fresh bananas from Central America and Ecuador, US cents per pound[1]

*Livestock:* US Producer Price Index for livestock, SCC No. 013[2a]

*Poultry:* US Producer Price Index for live poultry, SCC No. 014[2b]

*MINING*

*Copper:* London Metal Exchange cash price for high grade copper, US cents per pound[3]

*MANUFACTURING*

*Food products:* US Producer Price Index for processed foods, SCC No. 02, except beverages and beverage materials[2a]

*Beverages:* US Producer Price Index for beverages and beverage materials, SCC No. 026[2a]

*Tobacco products:* US Consumer Price Index for Urban Wage Earners (CPI-W) for tobacco products[4]

*Textiles:* US CPI-W for cotton or polyester blend yard goods[4]

*Wearing apparel:* US CPI-W for apparel commodities including footwear[4]

*Paper products:* US Producer Price Index for paper and allied products, SCC No. 08[2a]

*Publishing and printing:* US CPI-W for school books and supplies, 1978= 100[4]

*Chemical products:* US Producer Price Index for chemicals and allied products, SCC No. 08[2a]

*Petroleum products:* US Producer Price Index for refined petroleum products, SCC No. 057[2a]

*Nonmetallic mineral products:* US Producer Price Index for nonmetallic mineral products, SCC No. 13[2a]

*Metals and metal products:* US Producer Price Index for metals and metal Products, SCC No. 10[2a]

*Machinery and equipment:* US Producer Price Index for machinery and equipment, SCC No. 11[2a]

Table 2 (continued)

*CONSTRUCTION*

*Construction:* US Engineering News-Record Construction Cost Index, 1967=100[5]

*UTILITIES*

*Electricity, gas and water:* US CPI-W for fuel and other utilities[4]

*SERVICES*

*Land transportation:* US Implicit Price Deflator (IPD) for land transportation[6]

*Other transportation and communication:* US IPD for other transportation and communication[6]

*Wholesale and retail trade:* US IPD for wholesale and retail trade[6]

*Finance and insurance:* US CPI-W for insurance and finance[4]

*Hotel, restaurant and recreation services:* US IPD for hotel, restaurant and recreation services[6]

*Other private services:* US IPD for other private services[6]

Sources of data:

1. International Monetary Fund. *International Financial Statistics*, 1958-1981 Supplement on Price Statistics, 1982-1984 December issues and 1985-1987 June issues.

2. US Department of Labor, Bureau of Labor Statistics. *Wholesale Prices and Price Indexes*, data for January 1967 to December 1977. *Supplement to Producer Prices and Price Indexes*, data for 1978 to 1984. *Producer Price Indexes*, data for January 1985 to December 1986.

2a. Producer Price Index for Commodity Groups, Subgroups, Product Classes and Individual Items under the Standard Commodity Classification (SCC). 1967=100 unless otherwise indicated.

2b. Producer Price Index for the Output of Selected Industries under the Standard International Classification (SIC). 1967=100 unless otherwise indicated.

3. United Nations Committee on Trade and Development. Commodities Division. *Monthly Commodity Price Bulletin.* 1960-1984 Supplement and July 1987 Issue.

4. US Department of Labor. Bureau of Labor Statistics. *CPI Detailed Report.* January 1967 to December 1986 Monthly Issues. 1967=100 unless otherwise indicated.

5. US Department of Commerce. Bureau of Economic Analysis. *Survey of Current Business.* January 1967 to January 1987 monthly issues.

6. US Department of Commerce. Bureau of Economics Analysis. *The National Income and Product Accounts of the United States.* 1929-1982 Supplement to the Survey of Current Business. *Survey of Current Business.* 1966-1987 July Issues. 1982=100 unless otherwise indicated.

**Table 3**
**RESULTS OF PRICE TESTS**

| TEST I | | TEST II | | TEST III | |
|---|---|---|---|---|---|
| 1.0929* | Paper products | 0.8311* | Publishing | 0.00795 | Food products |
| 1.0678* | Textiles | 0.8309* | Land transportation | 0.01157 | Petroleum |
| 1.0072* | Corn | 0.8273* | Corn | 0.02576 | Nonmetallics |
| 0.9918* | Copper | 0.8162* | Trade | 0.03093 | Trade |
| 0.9757* | Trade | 0.8136* | Rice | 0.03316 | Beverages |
| 0.9736* | Petroleum | 0.8117* | Livestock | 0.03430 | Metal products |
| 0.9706* | Food products | 0.7853* | Utilities | 0.03591 | Finance |
| 0.9073* | Bananas | 0.7617* | Copper | 0.03649 | Livestock |
| 0.8983* | Coconut | 0.7559* | Poultry | 0.03785 | Coconut |
| 0.8773* | Wearing apparel | 0.7554* | Hotel services | 0.03822 | Tobacco products |
| 0.8739* | Other transportation | 0.7372* | Textiles | 0.04037 | Poultry |
| 0.8676* | Nonmetallics | 0.7280* | Other services | 0.04043 | Other transportation |
| 0.8380* | Land transportation | 0.7013* | Food products | 0.04140 | Chemical products |
| 0.8164* | Poultry | 0.6694* | Nonmetallics | 0.04282 | Land transportation |
| 0.8008* | Livestock | 0.6658* | Machinery | 0.04464 | Copper |
| 0.7958* | Chemical products | 0.6141 | Coconut | 0.04524 | Utilities |
| 0.7925* | Utilities | 0.6004* | Wearing apparel | 0.04610 | Corn |
| 0.7890* | Fishery | 0.6001* | Bananas | 0.05069 | Fishery |
| 0.7880* | Metal products | 0.5967* | Beverages | 0.05125 | Construction |
| 0.7661* | Tobacco products | 0.5906* | Metal products | 0.05278 | Machinery |
| 0.7333* | Beverages | 0.5554* | Construction | 0.05359 | Hotel services |
| 0.7255* | Machinery | 0.5521* | Petroleum | 0.05804 | Other services |
| 0.7155* | Finance | 0.5440* | Tobacco products | 0.05967 | Paper products |
| 0.7057* | Construction | 0.5234* | Chemical products | 0.06045 | Publishing |
| 0.7022* | Hotel services | 0.4944* | Paper products | 0.06418 | Wearing apparel |
| 0.7015* | Other services | 0.4810* | Finance | 0.08157 | Textiles |
| 0.6535* | Publishing | 0.4293* | Sugarcane | 0.08845 | Bananas |
| 0.6458* | Rice | 0.2986* | Other transportation | 0.09610 | Rice |
| 0.6385* | Sugarcane | 0.2801 | Fishery | 0.11875 | Sugarcane |

of generalized squared distance, assuming that each of the two sectors has a multivariate normal distribution (SAS Institute 1982). Since the classification criterion can be based on either the individual within-group variance matrices or the pooled covariance matrix, a likelihood ratio test of the homogeneity of the within-group covariance matrices was first made. Since the test statistic was significant at the 10 percent level, the covariance matrices were not pooled, and a quadratic discriminant function, instead of a linearized one, was computed. After taking into account the prior probabilities of each group, which were set to be proportional to the sample sizes, each industry was then placed in the sector from which it has the smallest generalized squared distance. The posterior probability of an industry belonging to each sector was also computed. The results are presented in Table 4.

**Table 4**
**RESULTS OF DISCRIMINANT ANALYSIS**

| Industry | Posterior probability of belonging to tradables sector |
|---|---|
| Paper products | 0.9335 |
| Textiles | 0.8892 |
| Bananas | 0.8372 |
| Other transportation and communication | 0.8196 |
| Sugarcane | 0.7421 |
| Wearing apparel | 0.7263 |
| Copper | 0.6894 |
| Petroleum products | 0.6790 |
| Corn | 0.6691 |
| Coconut including copra | 0.6362 |
| Chemical products | 0.5670 |
| Nonmetallic products | 0.5543 |
| Food products | 0.5393 |
| Tobacco products | 0.4867 |
| Wholesale and retail trade | 0.4811 |
| Metal products | 0.4641 |
| Finance and insurance | 0.4470 |
| Construction | 0.4423 |
| Fishery | 0.4227 |
| Poultry | 0.4013 |
| Machinery and equipment | 0.3903 |
| Land transportation | 0.3856 |
| Beverages | 0.3681 |
| Electricity, gas and water | 0.3635 |
| Rice | 0.3484 |
| Hotel services | 0.3365 |
| Other private services | 0.3297 |
| Livestock | 0.3178 |
| Publishing | 0.2106 |

It can be observed from Table 4 that sugarcane is kept in the tradables sector while publishing is reclassified ino the nontradables sector, together with three other industries — metal products, machinery and hotel services — which has been previously considered tradable. With due consideration given to the fact that the ratio for the sum of imports and exports to domestic output is 177 percent for machinery, 65 percent for metal products and 29 percent for

hotel services, and to the margin of error that has to be allowed for in the matching of domestic and foreign price indices, metal products, machinery and hotel services were retained in the tradables sector. Publishing was transferred to the nontradables sector since its ratio, 18 percent, was not as high. In the case of the industries considered as nontradables by the quantity criterion, only corn appeared to legitimately belong to the tradables sector because its domestic price moves closely with its world price and the exchange rate.

D. *Traded and Nontraded industries in the Philippines*

Table 5 presents the classification of 29 key Philippine industries into the tradables and nontradables sectors. This was used as the basis for the empirical testing of the model developed by the author in her dissertation. Among the agricultural industries, rice, livestock, poultry and fishery are in the nontradables sector while sugarcane, coconut, bananas and corn are considered tradables. The cost and ease of preserving foodstuffs for international transportation appears to be an important factor in determining whether an industry is tradable or nontradable. Since most livestock, poultry and fishery products can be preserved only for a limited time and at a substantial cost, their exportation is inhibited and domestic sources are relied upon to a great extent. Government control on prices and importation can also break the link between domestic and foreign prices, as in the case of rice. Although rice can be easily transported, the Philippine government has implemented a largely successful self-sufficiency program, controlled importation and exportation, and has set a ceiling on prices because of the central role of rice in the diet and budget of the average Filipino family. Thus, it is not internationally traded in significant amounts and its domestic price does not follow world price trends closely. Although similar self-sufficiency efforts were made for corn, the degree of success attained had not been as high as that for rice. Thus, corn is still considered a tradable good.

Among the light consumer industries, beverages, tobacco products and publishing are considered nontradables while food products, wearing apparel and textiles are tradables. The first three industries are basically import-substituting industries which are able to satisfy most of the domestic demand but are not competitive in world markets. Food products and wearing apparel, including footwear, also satisfy domestic demand adequately while at the same time being exported in significant amounts. On the other hand, most textiles are still imported, including those used for making garments

which are then exported since the locally-produced goods are poor substitutes.

Intermediate and capital producer goods are all tradables since most of these cannot be produced domestically and are therefore still imported. These include paper, chemical, petroleum, metal and nonmetallic products as well as machinery and equipment including transportation equipment.

Construction, utilities and most of the service industries belong to the nontradables sector. The only exceptions are water and air transportation and communication services which are supplied to a great extent by foreign nationals, and hotel, restaurant and recreation services which are tourist-oriented and generate foreign exchange earnings.

**Table 5**
**TRADABLE AND NONTRADABLE SECTORS**

| | Nontradables | Tradables |
|---|---|---|
| *Agriculture* | Rice<br>Livestock<br>Poultry<br>Fishery | Sugarcane<br>Coconut including copra<br>Bananas<br>Corn |
| *Mining* | | Copper |
| *Manufacturing* | Beverages<br>Tobacco products<br>Publishing and printing | Food products<br>Textiles<br>Wearing apparel<br>Paper products<br>Chemical products<br>Petroleum products<br>Nonmetallic products<br>Metal products<br>Machinery and equipment |
| *Construction* | Construction | |
| *Utilities* | Electricity, gas and water | |
| *Services* | Land transportation<br>Whole and retail trade<br>Finance and insurance<br>Other private services | Other transportation and communication<br>Hotel, restaurant and recreation services |

## III. CONCLUDING REMARKS

With the classification of the economy intro tradable and non-tradable goods sectors, it is now possible to estimate the demand and supply functions of the two sectors on both the aggregate level and industry-by-industry basis in order to get measures of the demand and supply elasticities of these sectors. Together with the savings and other parameters included in the theoretical model developed by the author in her dissertation, these estimates could now be used to predict the effect of a devaluation on real output.

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